



## D5.4 HiDALGO Support Concept

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<b>Lead Participant</b>	USTUTT	<b>Lead Author</b>	Dineshkumar Rajagopal
<b>Contributors</b>	PSNC	<b>Reviewers</b>	Derek Groen (BUL)
			Pawel Wolniewicz (PSNC)

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## Document Information

List of Contributors	
Name	Partner
Dineshkumar Rajagopal	USTUTT
Krzysztof Samborski	PSNC
Marcin Lawenda	PSNC

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Quality manager	Marcin Lawenda (PSNC)	27/03/2020
Project Coordinator	Francisco Javier Nieto de Santos (ATOS)	03/4/2020

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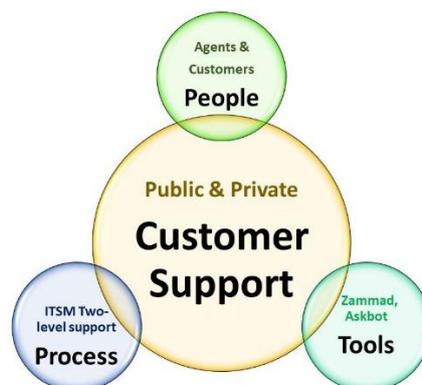
## List of Acronyms

Abbreviation / Acronym	Description
CI/CD	Continuous Integration / Continuous Deployment
COBIT	Control Objectives for Information and Related Technologies
CRUD	Create Read Update Delete
CSI	Continuous or Continual Service Improvement
DB	Database
EC	European Commission
eTOM	Business Process Framework
FAQ	Frequently Asked Questions
GC	Global Challenge
GLPI	French Acronym: Gestionnaire Libre de Parc Informatique
GUI	Graphical User Interface
HTTPS	HyperText Transfer Protocol Secure
ISACA	Information Systems Audit and Control Association
ISO	International Organization For Standardization
IT	Information Technology
ITSM	Information Technology Service Management
IDM	IDentity Manager
L1	Level-1 (basic support)
L2	Level-2 (expert support)
MOF	Microsoft Operations Framework
OAUTH2	Open Authorization V2
Q&A	Questions and Answers
RACI	Responsibility Accountability Consulted Informed
REST	Representational State Transfer
SAML	Security Assertion Markup Language
SIAM	Service Integration and Management
SLA	Service Level Agreement
SME	Small- and Medium-scale Enterprise
SSL	Secure Socket Layer
URL	Uniformed Resource Locator
VM	Virtual Machine

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# Executive Summary

This document defines the support concepts, processes and tools required to build a strong HiDALGO support system in the market for establishing an active community and build trust within the customer groups. HiDALGO support system adapts IT Service Management (ITSM) framework to provide an overview of the system and defines the support concepts to provide a guideline in the support provisioning. The support concept details the reasoning behind the design of multiple sub-supporting systems, the selection of multiple supporting tools, best practices in the support process, metrics to evaluate the system, roles and responsibilities of the agents to provide a rule-of-thumb in the service provisioning. HiDALGO support system introduces multiple sub-supporting systems (public support forum and private support ticket) to address a wide arena of customer base based on their issues' confidentiality level. HiDALGO support process follows a generic two-level support process to provide a basic (first) and an expert (second) support to resolve the customer issues on time with high quality. Support tools are the main ingredients to automate the process to reduce the burden of the agents in the operational phase. HiDALGO support tools selected from the open-source market by following market analysis to satisfy our requirements. The market analysis identifies Askbot and Zammad tools to provide services of the support forum and support ticket respectively. We installed these instruments in the production infrastructure to provide earlier user access for identifying further improvements in the tools to enhance the user experience. Askbot and Zammad tools support both the REST API and GUI interfaces, so this deliverable covers the important functionalities and feasibility of the HiDALGO portal integration in detailed with the HTTP REST calls and screenshots. Customer support provisioning is the intersection of processes, people and tools as shown in Figure 1, so this deliverable defines those entities concretely to establish a strong foundation in the support system and user management concepts. Continuous Service Improvement (CSI) principles are applicable throughout the system, so metrics defined at the different levels to ensure agility and continuous improvement in the service provisioning.



**Figure 1: Processes, tools and people are the three pillars to provide customer services effectively.**

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# 1 Introduction

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The support methodology is detailed in this deliverable to integrate the industrial best practices of support concepts, processes and tools within the project. We deem it to be one of the key ingredients to connect with end customers, build communities and establish a sustainable Centre of Excellence. The concepts, tools and methodologies introduced in this deliverable will be adopted in the course of this project to resolve the customer issues effectively to increase the level of customer expectations.

The private support ticket and public support forum are the two main sub-supporting systems envisaged to focus on the confidential and nonconfidential customer issues respectively. Two levels of support are given in the HiDALGO support system:

- Level-1 provides basic support in the rotational basis to make sure the ticket is responded to with the basic technical solutions.
- Level-2 provides expert support to resolve the customer issues and eradicate the root cause of the issue by leveraging the technical expertise from the corresponding WPs if Level-1 could not resolve the customer issues on time with expected quality.

The public support forum is aimed to build an active community by providing a customer platform for exchanging their problems, experiences and solutions within the HiDALGO tools and technologies. Level-1 help desk members are responsible for promptly answering the customer queries and stimulate the discussions to build an active community in the support forum. If the topic of discussion or support ticket is not resolved on time, then we provide Level-2 experts consultation and give their suggestions to ensure the issue is closed properly and the solution is archived in the FAQ. If an issue is raised in the private ticket and it is helpful for other customers, then the key information of the problem (without confidential information) will be archived in the public forum and FAQ for ensuring sustainability and knowledge sharing within the community. Metrics are defined at the different levels for regular evaluation to revise the process for providing better service, which is detailed in chapter 2.5. Roles and responsibilities for the two levels, metrics defined for evaluation, support system implementation and its operations are elaborated in the rest of the document to provide a concrete view about the support provisioning.

## 1.1 Purpose of the document

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This report presents the HiDALGO support concepts according to the requirements collected in D6.2 [1] and design are done in D5.2 [2]. This is the first definition and initial implementation of the support concept in task T5.2 to establish a strong foundation to create the HiDALGO support system. This document will be updated in future releases, according to the progress done in the support activities, portal integration, and EC feedback.

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## 1.2 Relation to other project work

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Customer support is given for different WP tools and technologies, so cross-functional knowledge transfer between WPs to resolve the customer issue is essential. Public support forum is introduced to build an active community, which closely relates to the activities of T7.1 in WP7. The public support forum is designed to establish a sustainable Centre of Excellence, which is closely related to T2.1 and T2.3 in WP2. The free support system defined here will provide a base for the commercial support (Consultation and Marketplace), so it is closely related to further activities in WP2 paid customer consultation and T5.3 marketplace solution definition. Stakeholder analysis [3] is addressed in the WP2, which is used to address customer segmentation in the support strategy. The service offering is addressed in the D6.2 [1] to define service portfolio management in the support strategy. Support tools will be updated in future deliverables (D5.6 and D5.7) when the HiDALGO portal integration requires any changes in the implementations, deployments, and configurations.

## 1.3 Structure of the document

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This document is structured in five major chapters:

- **Chapter 2** introduces the HiDALGO support methodology to give an overview of the support system with stakeholders (customer, service providers), a two-level support process for operations, different types of supports and their tools.
- **Chapter 3** details the public support forum, which is envisioned to use by the HiDALGO community to provide a platform for exchanging common problems, experiences and their solutions to manage an active community. The moderator is responsible for providing the correct solution for the problem and monitoring the answers posted by another community member to avoid duplication or spam in the questions and answers.
- **Chapter 4** details the support ticketing system, the tool is planned for resolving the confidential customer problems within the stipulated period and to ensure security during the ticket operations to leverage customer trust.
- **Chapter 5** concludes this deliverable and provides next steps.

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## 2 HiDALGO Support Methodology

Selecting a service management framework is the first step in defining all the support methodologies and concepts to establish a complete support system in the project. Multiple frameworks are available in the market and they are compared against the properties of scope, agility, adaptation, Forbes survey [6] of usage in industry and open-source standard as detailed in Table 1. IT Service Management-IT Information Library Version 4 (ITSM-ITIL V4) [4] is the framework selected from the market analysis due to the following reasons.

- Generic IT service management and concepts (technology agnostic).
- Empiricism, agility and CSI [5] principles to improve the services regularly.
- Open standard and easy to adapt within the mid-size projects.
- Practical implementation in the various industrial projects.
- ITSM-ITIL V4 is the most widely used framework in the industries for managing IT services as per the Forbes ITSM survey [6]. The sum of the Forbes survey percentage is not equal to 100%, due to the reason of multiple frameworks used in the industries to provide an IT service.
- ITSM-ITIL V4 framework details basic principles and support concepts, which is the base for all the other frameworks in Table 1.

Service Management Frameworks	Scope	Agility & CSI	Adaptation	Open-Standard	Forbes ITSM Survey
Business Process Framework (eTOM) [7]	Telecom Industry service management	NO	Not generic to apply within the project.	Yes (managed by Tele Management Forum)	36%
Control Objectives for Information and Related Technologies [8]	Large-scale IT Projects	Yes	Hard to adapt, due to a large number of specific processes to apply within the big IT projects.	Proprietary (managed by Information Systems Audit and Control Association)	36%

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Service Management Frameworks	Scope	Agility & CSI	Adaptation	Open-Standard	Forbes ITSM Survey
International Organization For Standardization (ISO 20000) [9]	IT Organization standards and Quality management.	Yes	Hard to adapt, due to the abstract and high-level management concepts applicable to the IT organization level.	Proprietary (managed by ISO)	29%
ITSM-ITIL V4 [4] (Selected from market analysis)	Technology, Business and Organisation agnostic. The basis for all the other frameworks in the market.	Yes	Easy to understand, adapt and flexible to fit with the mid-size project.	Yes (managed by IT Information Library)	47%
Free and lightweight IT Service Management (FitSM) [10]	A simplified version of ITSM. Support concept is not organized properly to follow a procedure (strategy, design, implementation and operation).	Yes	Easy to adapt, due to its simplicity.	Yes (managed by IT Education Management Organisation)	18%
Microsoft Operations Framework 4.0 [11]	Competitor and alternative for ITSM. Support concept is not organized properly to follow a procedure (strategy, design,	Yes	Hard to adapt, due to a large number of specific processes to apply within the big IT projects.	Proprietary (managed by Microsoft)	34%

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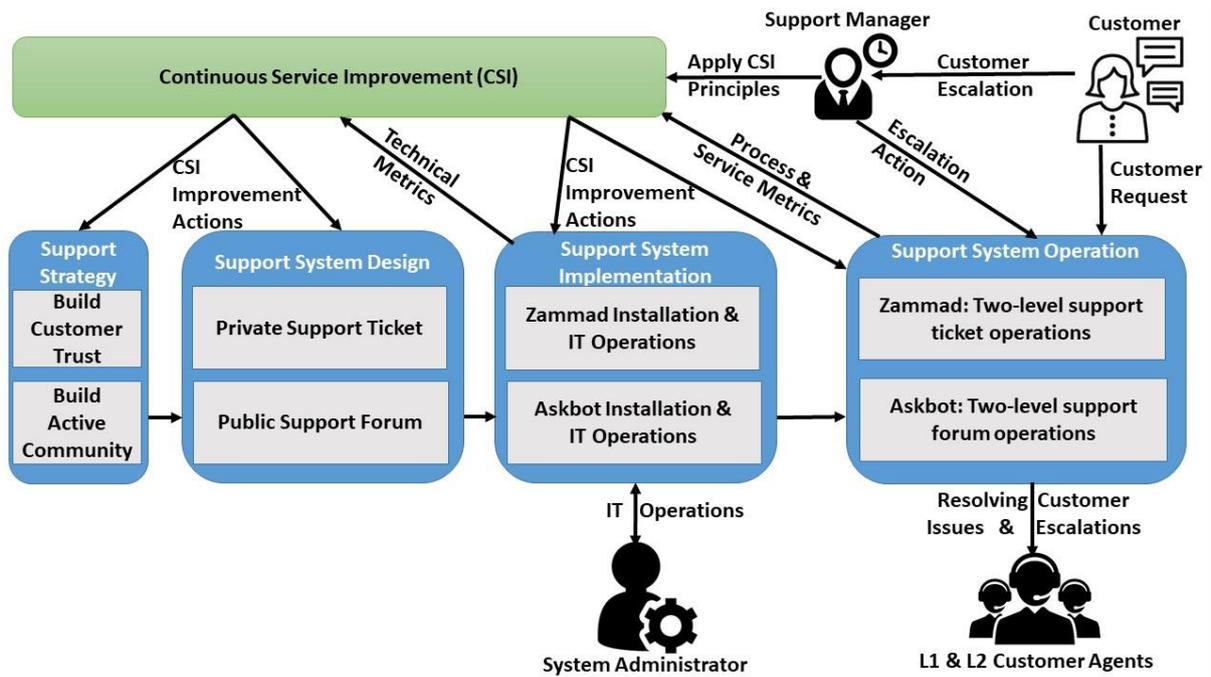
Service Management Frameworks	Scope	Agility & CSI	Adaptation	Open-Standard	Forbes ITSM Survey
	implementation and operation).				
Service Integration And Management (SIAM) [12]	Multiple supplier management and system integration.	No	Not generic to apply within the project.	Yes (managed by Axelos)	21%

**Table 1: Market analysis of service management frameworks.**

ITSM-ITIL V4 is an empirical framework for designing, implementing and operating a support system based on the needs of the customers and projects, so it is a viable framework to apply within the project to provide competitive customer support in the market. ITSM-ITIL V4 service management framework is adapted within the project to define all the support concepts (support strategy, support design, support transition, support operation and support metrics) as shown in Figure 1, which is detailed in the respective sub-chapters.

- **Support Strategy:** The support system strategy is the key ingredient to provide the direction of the support activities and it is the main input for other stages in the ITSM framework. Support strategy must align the support operations with business objectives to achieve the business values, which is detailed in sub-chapter 2.1.
- **Support Design:** Support design is based on the input of support strategy and it is aimed with minimal change in the future to enable smooth support operations in the project lifetime. The design is based on the customer segment and strategic value, which is detailed in the sub-chapter 2.2.

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**Figure 2: Different stages of the HiDALGO support concept implementation. Every stage in the support concept depends on the outcome of the previous stage (Eg. Support design is based on the outcome of the support strategy).**

- Support Transition / Support Implementation:** The support system is required to implement the tools to realize the designed services and automate the support process. The tools are the medium to raise a request by customers and establish the automatic process to ensure the quality in service provisioning. Different tools for the support system are available on the market, which is selected and installed based on the criteria of easy usage and feasible integration with the HiDALGO portal, which is detailed in sub-chapter 2.3, chapter 3 and 4.
- Support Operation:** Support execution is realized at this stage, so the two-level support process is implemented and the service operation is performed by support agents to resolve the customer issues on time. Two-level support process and the support agents' responsibility is detailed in sub-chapter 2.4.
- Continuous Service Improvement:** Support concepts define the metrics required to measure the support system's health and improve the service quality based on these measures. Sub-chapter 2.5 gives more details regarding the definition of different metrics and CSI principles.

## 2.1 Support Strategy

HiDALGO support strategy is to build an active HiDALGO community and build trust within the HiDALGO customers by offering free support, which is the key ingredients for commercial support and sustainable business operations. Customer segmentation is not covered in this

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deliverable, which is closely related to WP2 stakeholder analysis and detailed in D2.1 [3]. The support is given for the external customers (Big industries, small- and medium-scale enterprises, academic researchers, programmers and confidential researchers) to resolve their issues faced in the HiDALGO tools and technologies. The service portfolio is based on the Global Challenges (GC) and the High-Performance Computing, High-Performance Data Analytics, Artificial Intelligence tools developed and techniques used for the GC problems, which is detailed in D6.2 [1]. Customer support is possible with customer queries and their interests, so our support services will be promoted through WP7 communication as mentioned below.

- HiDALGO support page will be created on the official website to share the support contacts ([support@hidalgo-project.eu](mailto:support@hidalgo-project.eu)) and support tools web-links.
- Support email contacts and support tools web-links will be shared in the HiDALGO official social networks, upcoming posters and workshops to leverage the existing community created from WP7.

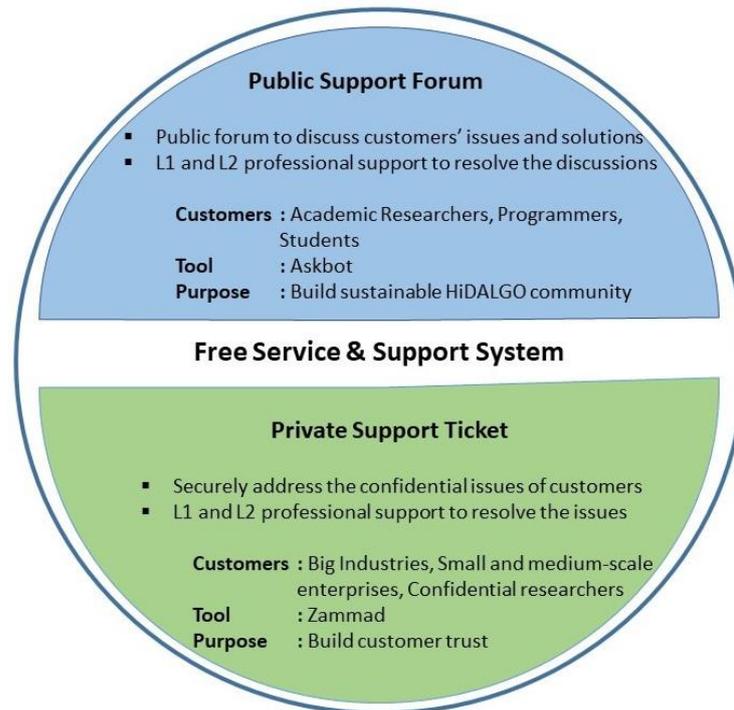
## 2.2 Support system design

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The HiDALGO support system is designed with the motive of addressing different customer segments based on the strategic value. The strategic value (build a sustainable community and the trust of customers) is based on the confidentiality of the customer issues, so two different sub-supporting systems are designed based on the criteria of confidentiality as shown in Figure 3. Customer trust is built by processing customer issues on time with high security, so the private support ticket system is designed to address the confidential customer issues securely. An active and sustainable community is created by establishing a support forum to publicly discuss customer problems, solutions by the community and for the community. Figure 3 details the objective of supports, customer mapping and selected support tools, which is the summary of the support concepts and its outcome.

The support forum provides a public platform for fostering community interaction between customers to share their common concerns and experiences. The discussion forum is a medium for HiDALGO users to help themselves and create a sustainable community for the long run. The Level-1 support provider is responsible to stimulate the discussion and to moderate the Q&As to provide the correct solutions for building an active, sustainable community. Academic researchers, programmers and students are the targeted customers, so the functionality of the selected forum tool will be evaluated with them for identifying further improvements in the tool.

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**Figure 3: The support activities, customers, tools and purpose are detailed for the different sub-supporting systems.**

The private support ticket is introduced with the focus of addressing confidential customer issues with a high level of integrity and manage their information securely to resolve the customer issues and build trust with them. Big industries, SMEs and confidential researchers are the targeted customers for this system, so the functionality of the selected support ticketing tool will be evaluated with them for identifying further improvements in the tool.

Resource capacity and their availability are detailed below to handle customer queries on time with high-quality.

- The L1 agent could spend an average of one working-hour per day to provide a basic solution and collect more information for the requests within a day. L1 support can handle an average of ten customer requests per day. Two L1 agents are working on a biweekly rotational basis.
- The L2 agent could spend an average of one working-hour per day to provide an expert solution. L2 support can handle an average of twenty customer requests per week. Bug management, feature requests may take one week to give concrete solutions, so at the time it would be expected less than twenty customer requests per week. Every WP is having an L2 agent to address the L2 issues collectively or individually to provide an expert solution.
- The support manager spends an average of one hour per day to handle the escalations. Support manager can handle an average of ten customer escalations in a

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day. One support manager is assigned to handle the escalation, ITSM process management and applying CSI principles in the support system.

- Customer request, number of ticket closure is not static and predictable exactly at the starting phase so that CSI principle is introduced to improve the service iteratively by every two weeks. Customer request is expected to be low at the starting phase, so the bandwidth of handling ten customer requests per day by L1 agents and twenty customer requests per week by L2 agents is enough to start the service operations.

Integrity and security management is required to ensure confidentiality and build trust within the customers, which is detailed below.

- Customer critical information and their critical issue details are not allowed to share with others.
- Confidential information of the project should not be shared with customers and anonymous persons.
- User credentials, server infrastructure details, private key should not be shared in the public.
- User credentials are forced to reset for every three months by enabling automatic policy in the Keycloak IDM or specific applications to reduce the chance of security vulnerabilities.
- If there is any data or security breach, then it should be informed to the support manager for taking immediate recovery actions. Support manager can conduct the conference call to resolve the security breach within the day.

## 2.3 Support system implementation/transition

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Support tools identification is followed by detailed market analysis, which is detailed in the following sub-sections 2.3.1 and 2.3.2 for the private support ticket and public support forum respectively. Sub-chapter 2.3.3 gives an overview of the support infrastructure provisioning and automatic software management principles with Ansible and Jenkins for the support tools. Chapter 3 and 4 detail the installation and functionalities for the selected supporting tools (Askbot and Zammad respectively).

### 2.3.1 Market analysis of private support ticket

The different supporting ticket tools are available in the market, but the scope is to select the best open-source tools from the market for satisfying our requirements. GUI support, Create tickets by Email, Keycloak IDM SSO support, Ticket escalation and SLAs are the main features needed to provide a stand-alone service and integrate easily with the HiDALGO portal, so multiple tools are compared against those features and summarized in Table 2. Zammad is

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the tool chosen based on the market analysis and installed in our production VM based on the following reasons.

1. Regular stable release and security fixes ensure the quality of the application.
2. Provide support for Unix systems (Debian, Centos based systems).
3. Active community support to resolve issues in the tools quickly.
4. Zammad GUI interface is very new and it is completely different from other supporting tools. This is the next generation supporting system providing an easy interface to use the system without any further explanation.
5. A ticket search engine is provided to search the tickets based on multiple keywords (similar to a search engine for queries).
6. Tickets are filtered based on different criteria.
7. Using different new technologies to ensure the tool is up to date. Elasticsearch is used to optimize the speed of searching.
8. Zammad is developed using Ruby and Ruby-on-Rails framework, so changes or customizations in the future are possible.
9. Third-party authentication (OAuth2 and SAML) is provided implicitly, so the service will be integrated easily with the HiDALGO web portal with very minimal changes in the Zammad configuration by enabling the required features.
10. Automatic spam detectors are available to remove duplicate and spam tickets to protect from brute-force attack, etc.

These all are the features make us fond of selecting Zammad as the single-best choice among others to provide a standalone service to satisfy customer needs.

Support Ticket Name	Graphical User Interface	Email raise ticket	to a Ticket Escalation & SLA	Automatic Email response	Keycloak IDM SSO (OpenID or SAML) support
Bugzilla [13]	Yes	No	No	Yes	Third-party plugin
Gestionnaire Libre de Parc Informatique (GLPI) [14]	Yes	Third-party plugin	No	Yes	Third-party plugin
Launchpad [15]	Yes	No	No	Yes	No
Mantis Bug Tracker [16]	Yes	No	Yes	Yes	Third-party plugin

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Support Ticket Name	Graphical User Interface	Email to raise a ticket	Ticket Escalation & SLA	Automatic Email response	Keycloak IDM SSO (OpenID or SAML) support
OS Ticket [17]	Yes	Third-party plugin	No	Yes	Third-party plugin
Open-project bug tracking [18]	Yes	No	No	Yes	No
Open-source Ticket Request System [19]	Yes	No	No	Yes	No
Project-open [20]	Yes	No	Yes	Yes	No
Redmine [21]	Yes	Third-party plugin	No	Yes	Third-party plugin
Request Tracker [22]	Yes	No	No	Yes	Third-party plugin
<b>Zammad [23] (Selected from the market analysis)</b>	<b>GUI is easy to follow up by users</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

Table 2: Market analysis of supporting ticket tools.

### 2.3.2 Market analysis of public support forum

In order to find the best candidate to fulfil the defined goals for support form, a market analysis of existing products has been conducted. Several characteristics were taken into account, such as offered capabilities, configuration flexibility and restrictions imposed by the solutions. Analysis of tools that are no longer supported have been omitted. Findings of this research are presented in Table 3.

Tool	Advantages	Disadvantages
Askbot [24][13]	<ul style="list-style-type: none"> <li>Free software, self-hosted</li> <li>Supports LDAP, OpenID and OAuth</li> <li>Fully customizable user interface</li> </ul>	<ul style="list-style-type: none"> <li>No SAML 2.0 authentication</li> <li>REST API is read-only</li> </ul>

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Tool	Advantages	Disadvantages
	<ul style="list-style-type: none"> <li>• Captcha support for bot prevention</li> <li>• User reputation system</li> </ul>	
Qhub [25]	<ul style="list-style-type: none"> <li>• Simplified deployment and maintenance</li> <li>• Embeddable into any website</li> </ul>	<ul style="list-style-type: none"> <li>• Paid-service and not self-hosted</li> <li>• Privately owned</li> </ul>
Question2Answer [26]	<ul style="list-style-type: none"> <li>• Free software, self-hosted</li> <li>• Add-on support for language and appearance support</li> </ul>	<ul style="list-style-type: none"> <li>• Without plugins, it is very basic</li> <li>• No option to disable standard login</li> </ul>
Questions for Confluence [27]	<ul style="list-style-type: none"> <li>• Integration with various services via REST API</li> </ul>	<ul style="list-style-type: none"> <li>• Paid &amp; proprietary solution</li> </ul>
StackExchange Area51 [28]	<ul style="list-style-type: none"> <li>• Based on the popular Stack Overflow platform</li> </ul>	<ul style="list-style-type: none"> <li>• Closed &amp; proprietary</li> <li>• Using it requires fulfilling requirements and approval process</li> </ul>

**Table 3: Comparison of available support forum tools.**

There are numerous tools available on the market, each with its own advantages and disadvantages. Finally, the Askbot system was chosen. The main reason behind this was that it can serve its purpose out-of-the-box along with having stable support. Moreover, it features comprehensive functionality with exceptional customizability and full control over its management making it a preferred option.

### 2.3.3 Support Infrastructure

Support infrastructure (Integration and production VMs) are provided for both Zammad and Askbot tools to give services online for earlier user access, which is detailed in Table 4. Initial specifications of VMs are provided by following the official hardware specification documentation from the respective tools. Askbot does not have the hardware specification details, so we offered similar configurations of Zammad to start the service provisioning. If the resource usage is high and the web page access is slow, then VM hardware specification can be increased manually to provide the services with good performance for improving user experience.

Ansible scripts [29] were used for automating the software deployment and maintaining the reproducibility in the software installations. Jenkins pipeline [30] will use those Ansible scripts to provide a CI/CD pipeline for the HiDALGO portal to accelerate the portal integration and

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development activities. More details regarding the CI/CD pipeline (with Ansible and Jenkins) and its infrastructure are detailed in D5.3 [31].

Sub-supporting System	Selected Tools	Hardware Requirements & Scalability	Integration VM & sub-domain	Production VM & sub-domain
Private Support Ticket	Zammad [23]	Cores: 4 Memory: 6GB Disk Space: 10 GB (based on the usage) Users: 40 concurrent agents	Cores: 4, Memory: 8GB, Disk: 40GB, DNS: <a href="https://sophora-210.man.poznan.pl/">https://sophora-210.man.poznan.pl/</a>	Cores: 4, Memory: 12GB, Disk: 30GB, DNS: <a href="https://support.hidalgo-project.eu/">https://support.hidalgo-project.eu/</a>
Public Support Forum	Askbot [24]	No official specification from Askbot. Initially the VM sizing is similar to Zammad.	Cores: 4, Memory: 8GB, Disk: 40GB, DNS: <a href="https://sophora-76.man.poznan.pl/">https://sophora-76.man.poznan.pl/</a>	Cores: 4, Memory: 12GB, Disk: 30GB, DNS: <a href="https://ask.hidalgo-project.eu/">https://ask.hidalgo-project.eu/</a>

**Table 4: Virtual Machines and sub-domains provided for the HiDALGO support system.**

Technical risks are addressed in the transition phase to provide secure and effective IT operations as mentioned below.

- Zammad and Askbot data are very sensitive, so it requires automatic backup and restores mechanisms to protect from vulnerability and data loss. Zammad provides the script to backup application-level data in a compressed file, which can be enabled on the CRON job scheduler to automate the backup. VM image backup or application-level data backup has to be enabled for securing the data. Askbot will provide the scripts to automate the backup and restore procedure for securing the data.
- Software and OS upgrade has to be done for every stable release. Security patches are required to apply regularly to ensure secure service provisioning.
- All the service tools and VMs will be monitored by using the automatic monitoring tools (e.g. Nagios) to ensure the proper operation of service and the resource utilization is not higher than 90% of allocated resources to ensure effectiveness in the

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IT operations. If the system resource consumption is more than 90% of allocated, then the corresponding overused resource will be increased manually to fit with the bandwidth of customer requests to improve user experience.

- Alert the service tools failure and high resource utilization to system admin by Email.
- HLRS network is protected with a firewall and the port restriction is activated in the VM to enable only HTTPS public access for encrypting the user web connection.
- System admins can log in to the VMs by using the public-key authentication and password login is disabled in the VMs for protecting from brute-force attack.
- Web server logs are monitored to analyse the security attack (brute-force) and unauthorized accesses to ensure secure IT operations.
- If the support tool is down and not accessible, then the system admin has to resolve it during the working hours to make sure the application is available within a day.

## 2.4 Support system operation

The HiDALGO support system is operated generally by following a two-level support process to resolve the customer requests within the stipulated period. Different stages of the ticket operation and its statuses are informed regularly to the customers and support manager by L1 and L2 support agents to ensure healthy communication within the system. Different support levels, entities and their responsibilities are detailed in Table 5, which is based on the RACI responsibility assignment matrix and it is common for both public support forum and private support ticket. RACI matrix terms are detailed below for giving clarity in the understanding of the terms in Table 5.

**Responsibility:** The person is responsible to carry out the activity to get the jobs done.

**Accountability:** The person who owns the whole support system and take decisions.

**Consulted:** Subject matter experts are consulted before, after and during the activities.

**Informed:** Work progress is informed by email to ensure healthy communication.

Entities	Technical Expertise	Responsibility	Accountability	Consulted	Informed
Consumer					Yes
Support Manager	Reflect upon the support methodology.		Yes		Yes
L1 basic Support	Basic technical knowledge and incident management.	Yes		Yes	
	Solution consultation for GC, HPC benchmarking, HPC application and				

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Entities	Technical Expertise	Responsibility	Accountability	Consulted	Informed
<b>L2 expert Support</b>	coupled simulation, HPC & HPDA infrastructure, HPDA and AI application, Data management, Training	Yes		Yes	

**Table 5: Different entities and their responsibilities are assigned based on the RACI matrix for both support forum and support ticket.**

Operational risk is listed below for reducing risks in the support operations.

- L1 support agent is available during working hours (five working days and one hour per day). Sick, vacation or other reason for agents' unavailability is notified to the customer by automatic email or alternative agent to take the responsibility to address the L1 customer issues.
- If the issue is not resolved on time from L1 and L2 agents, then the technical reasoning and challenges are communicated to the support manager. Support manager will explain the situation to the customers for managing escalation and customer satisfaction.
- The support manager is responsible for addressing the escalation request by coordinating all the entities (Customers, L1 and L2 agents) to resolve the issues and meet the customer satisfaction. The support manager can also conduct an escalation call to coordinate all the entities to bridge the gap between customer issues and its relevant solution.

Incident and problem management are defined to address the different categories of customer issues as mentioned below.

- Tickets are categorized as incidents, bug, technical assistance, new features request by L1 agents after getting the new ticket.
- Incidents are further classified as disruption of service, performance degradation, which will be addressed by the respective internal service provider and L1 agents to make it run within two working days. The data breach is also considered a security incident, which will be high-priority and it has to be fixed within a day.
- Bugs are raised for the specific tools, and it has to be handled by respective tools developers to analyse the reasoning within a day to give feedback to customers and L1 agents. A complete resolution has to be given with the bug fixes and its patches to the customers within a week by respective tools developers and L2 agents. If the project is stable and tools are mature enough, then the number of bugs and support tickets will be decreased gradually, so this will be used to measure the maturity level as well.
- Technical assistance is the query regarding the project, services and tools, which is required to clarify by L1 or L2 agents within a day.

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- A new feature request is handled by L1 agents to collect more information within a day and reroute the tickets to L2 agents for feasibility, business relationship management and commercial value evaluation to give feedback to L1 agent and customers. New feature requests have to be processed within a week and change the ticket status (Acceptance, Rejection or Holding). The number of new feature requests is used to measure the interest and expectations of the community regarding the project.
- Support tickets can be resolved within the SLA period by applying a temporary fix or patch. Proactive problem management practice has to be implemented to analyse the root cause of the incidents after closing it and it has to be eradicated to reduce the number of further incidences in the future. There is a possibility of multiple incidents causes the same issues, so L1 and L2 agents can club multiple tickets into a single problem to address the root-cause issue during the ticket operation to reduce the time required for solving multiple tickets.
- Knowledge sharing documentation and rotational shift handover documentation are provided while changing the shifts of agents or escalating tickets from one level to another level. The number of documents and its frequencies is helpful to measure the smooth operations and proper handover in the HiDALGO support operations.
- Customer satisfaction, empathetic communication and earlier response are the essential qualities within the support operations to create an impact on the customers' service provisioning.

## 2.5 Metrics & Continuous Service Improvement

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The HiDALGO support concept is defined with the metrics to evaluate the functionalities of the HiDALGO support system at the regular interval by following the CSI [5] principles. The metrics are defined for different categories (technical, process- and service-levels) to evaluate all the levels of support concepts and support processes for providing improvement actions. The support manager collects the metrics from the support tools regularly for identifying further improvements in the service provisioning by applying CSI principles. CSI principle is based on the quality management concepts (Deming cycle [32], CSI seven-step improvement process [5]) to improve the quality of service provisioning by collecting metrics and implementing improvement actions iteratively on the support system as shown in Figure 4. The CSI process and its retrospective activities are conducted biweekly once to ensure agility and proactiveness to improve the services during the project lifetime.

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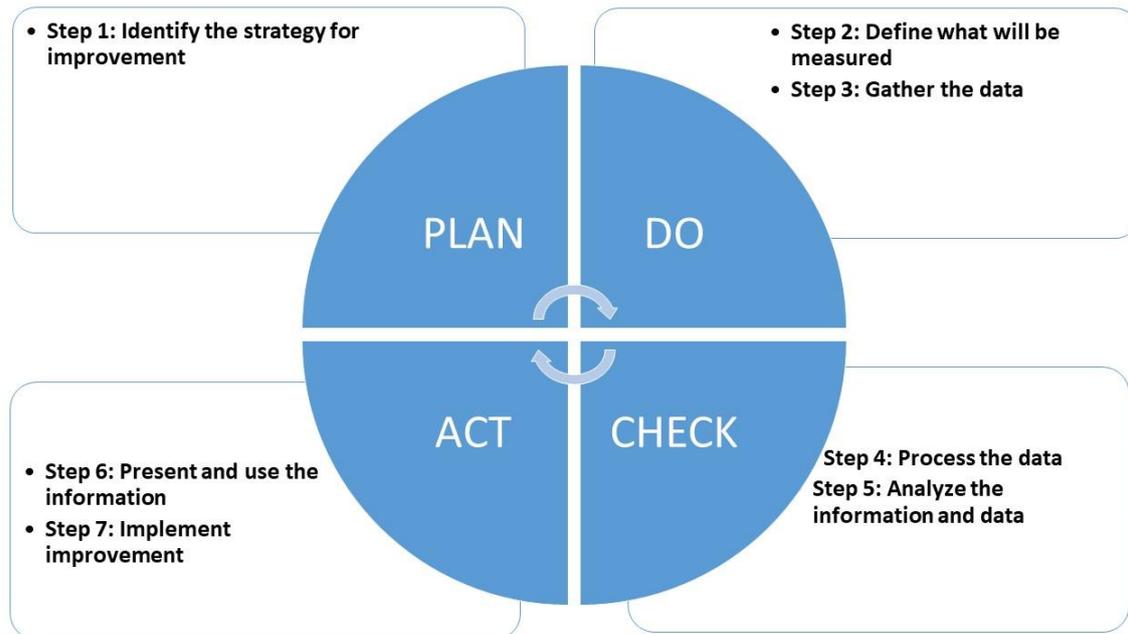


Figure 4: CSI seven-step improvement process [5].

### 2.5.1 Technical Metrics

Support tools are required to run properly to provide the best support services online. Technical metrics are defined between the support manager and system administrator to ensure the proper IT operations, which is detailed below.

- Support infrastructure and tools are required to run with the best effort high availability.
- If there is a failure in the infrastructure or support tools, it has to be fixed within a day (during working hours).
- Jenkins and Ansible script has to be given for both Zamamd and Askbot for ensuring reproducibility in the installation.
- Automatic software backup mechanism or backup script is provided to ensure protection against the data vulnerability.

### 2.5.2 Process & Service Metrics

Process metrics are the operational level agreements between the support manager and L1, L2 support agents. This is the metrics to evaluate internal operations and it is the soft-deadline for support agents to close the tickets. If the problem is not resolved within the process metrics, then the internal escalation would be raised automatically from the tools or the support manager. The support manager will collect more information regarding the issue and ensure the ticket is closed within the service metrics.

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The service metric is defined and agreed between the support manager and the customer. This is the external metrics and this is the SLA defined between customers, so it is a hard deadline for support agents to resolve the issue. If the problem is not resolved within the SLA period, then the escalation would be raised automatically from the tools or the customer, then support manager has to conduct the escalation procedures to resolve the issue and manage the customer satisfaction. Service metrics are defined two times the process metrics to reduce the number of customer escalation, which is detailed in Table 6. The number of tickets handled per week in Table 6 is the number of tickets handled by an agent during working days (one agent working for an hour per day for five working days).

Ticket Type	Sub-ticket & Actions	Support Agent	Process metric	Service metric	Number of tickets handled per week	Average Time required per ticket
New Ticket	Ticketing tool sends an automatic email.	Tool	< 5 minutes	< 10 minutes	Unlimited	< 1 minute
Technical assistance	Basic solution.	L1	< 1 day	< 2 days	> 50	< 5 minutes
	Expert solution.	L2	< 3 days	< 6 days	> 20	< 15 minutes
Bug	Collect scenario and reproducibility details.	L1	< 1 day	< 2 days	> 50	< 5 minutes
	Fix the bug and share the patch to the customers.	L2	< 5 days	< 10 days	> 1	< 5 hours
Incident	The security breach, Disruption of service, Performance degradation basic fix.	L1	< 1 day	< 1 day	> 1	< 5 hours
	The security breach, Disruption	L2	< 2 days	< 2 days	> 1	< 5 hours

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Ticket Type	Sub-ticket & Actions	Support Agent	Process metric	Service metric	Number of tickets handled per week	Average Time required per ticket
	of service, Performance degradation expert fix.					
New feature request	Collect more details regarding the request.	L1	< 1 day	< 2 days	> 50	< 5 minutes
	Evaluate the feasibility and give feedback to customers.	L2	< 5 days	< 10 days	> 1	< 5 hours

**Table 6: Different support ticket types and its process and service metrics for L1 and L2 agents.**

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## 3 Public Support Forum (Askbot)

The HiDALGO user support solution will be delivered via the request for answers service. The high-level goals of such a system are: the possibility to exchange information publicly and to allow the community and helpdesk members alike to help with common issues, the creation of a permanent, open knowledge base, and finally, facilitating community interaction by commenting, voting and notifications.

Low-level goals have been already listed in section 4.3.5 of report D5.2.

### 3.1 Installation of Askbot

There are several ways to install and configure Askbot. It can be done by installing components separately, running application with Docker container engine [33] along with the database or even creating a snapshot of a virtual machine.

It was decided to simplify the installation process using the Ansible automation platform [29]. The script prepares the remote machine for Docker usage, then downloads appropriate images and deploys them with the proper configuration in order to provide secure and stable service operation.

Particular components of the system are presented in Figure 5.

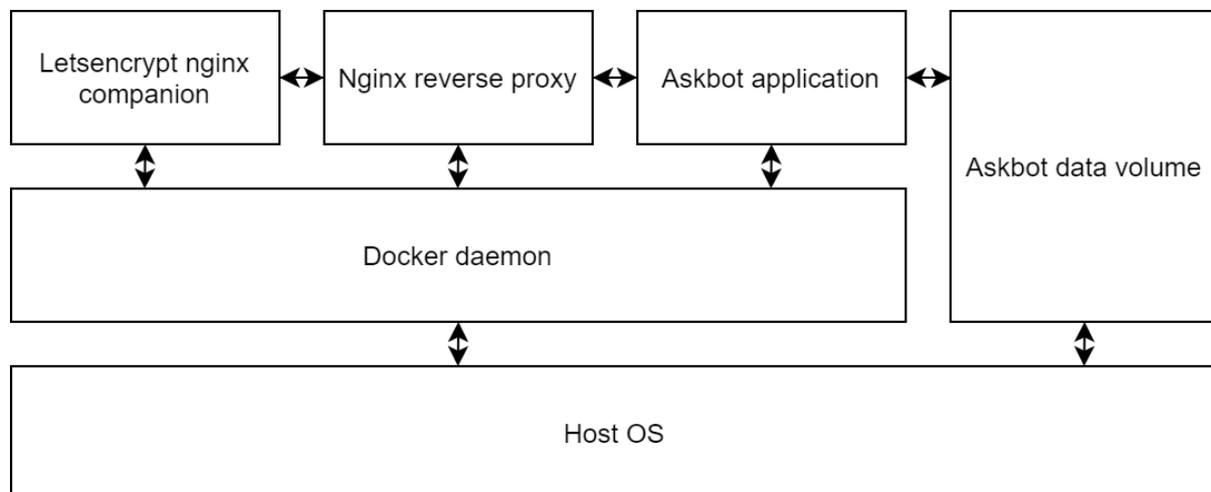


Figure 5: Askbot deployment architecture.

The following components can be distinguished:

- **Docker daemon** – it is the layer that provides an environment for application packages (containers) to run in.
- **Nginx reverse proxy** – container hosting the Nginx web server.

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- **Letsencrypt Nginx proxy companion** – container providing X.509 certificate for Transport Layer Security [34] encryption for Nginx web server.
- **Askbot application** – container with backend server processing business logic of the support forum and serving content.
- **Askbot data volume** – this folder is mounted to the Askbot container and allows to store any user, database and configuration data in a permanent location. It can be accessed directly from the host OS as well which helps set up configuration and backups.

## 3.2 Usage of Askbot

Askbot provides a web application with a graphical user interface. Even without logging in, it is possible to browse existing questions and answers. A detailed view of a question is presented in Figure 6.

Posting a new question, however, requires an account. After clicking “Ask your question” button the user sees a new question form (depicted in Figure 7). There, it is possible to give a title and detailed description of the issue and also assign tags. The description permits advanced text formatting and can contain links, images and code snippets.

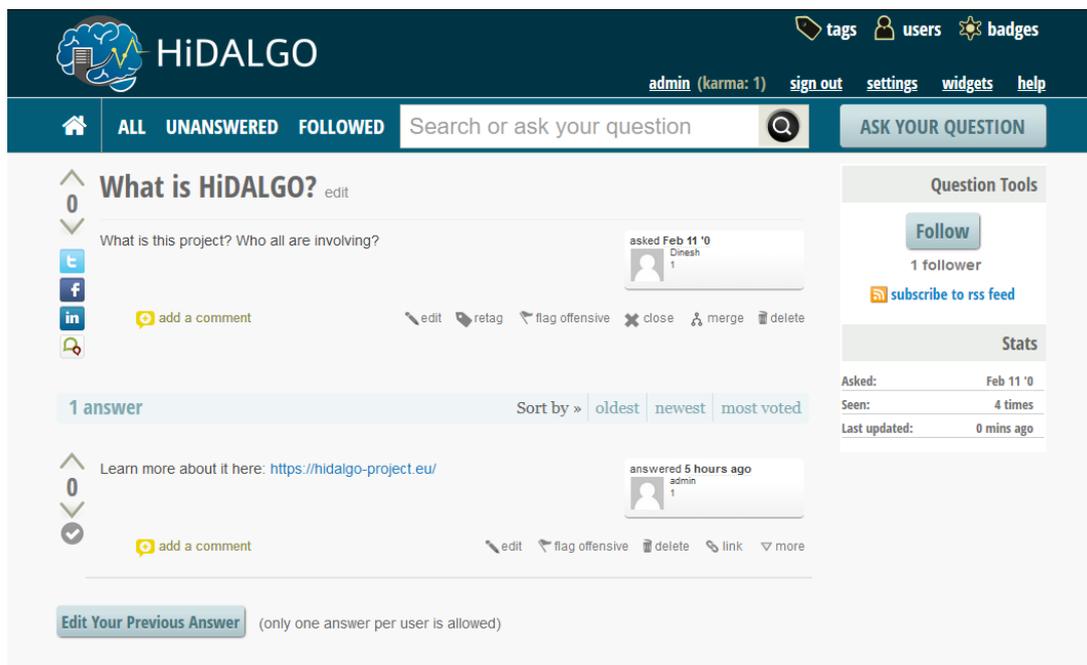


Figure 6: View of the question page.

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 **HiDALGO**

[tags](#) [users](#) [badges](#)  
[admin \(karma: 1\)](#) [sign out](#) [settings](#) [widgets](#) [help](#)

🏠 **Please ask your question here**

- ask a question interesting to this community
- provide enough details
- be clear and concise

*Please enter your question*

*Add details*

B I 🌐 “ ” 📷 ✍️ ☰ ☰ ☰

[hide preview]

*Tags*

Tags are short keywords, with no spaces within. Up to 5 tags can be used.  
To post on behalf of someone else, enter user name and email below.

community wiki (karma is not awarded & many others can edit wiki post):  
 post anonymously:

Ask Your Question

**Markdown basics**

- `*italic*` or `_italic_`
- `**bold**` or `_bold_`
- `link:[text]`  
(`http://example.com/ "title"`)
- `image:[alt text]/(path/img.jpg "title")`
- numbered list: 1. One 2. Two
- basic HTML tags are also supported

Figure 7: New question page.

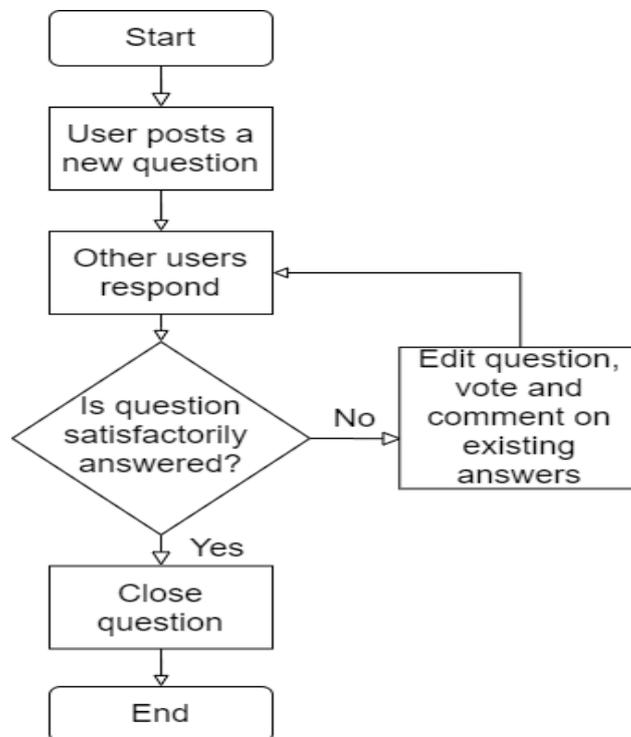


Figure 8: Issue life cycle flowchart for the Askbot support forum.

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### Support forum life cycle

After the issue is posted it becomes public and other users can interact with it. The question can be answered, voted and commented. This life cycle of an issue is presented in Figure 8.

### REST APIs

Askbot allows any user to use its REST interface to access forum data. The response comes in JSON format. This can be used to gather statistics, send notifications and integrate the service with other systems. Available commands are presented in Annexes Table 8.

More information about API calls is available on the official GitHub page<sup>1</sup>.

## 3.3 Integration with the HiDALGO portal

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### Single Sign-On

The Askbot system features an extensive configuration system that gives control over many aspects of service behaviour and allows for tight integration with the existing ecosystem.

There are numerous ways to authenticate a user to Askbot – password, CAS, OpenID, OAuth2, LDAP, AOL, Blogger, ClaimID, Facebook, Flickr, Google Plus, Mozilla Persona, Twitter, MediaWiki, LinkedIn, LiveJournal, Technorati, Wordpress, Vidoop, Verisign, Yahoo, identi.ca, LaunchPad and finally OpenStackID. This variety gives more flexibility when choosing a universal Single Sign-On method for HiDALGO services.

### Enhancement in the Tools

The functionality of Askbot can be enhanced using custom Javascript code, running on the client-side. Also, if needed, external services can be used in order to facilitate content sharing or protect against spam. Apart from these, all static content (license, logos, etc.), URLs and UI elements can be customized as well. Finally, because the service is open-source, it is possible to create modifications to the service directly, creating an own version of Askbot.

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<sup>1</sup> GitHub page <https://github.com/ASKBOT/askbot-devel/blob/master/askbot/doc/source/api.rst><sup>1</sup>

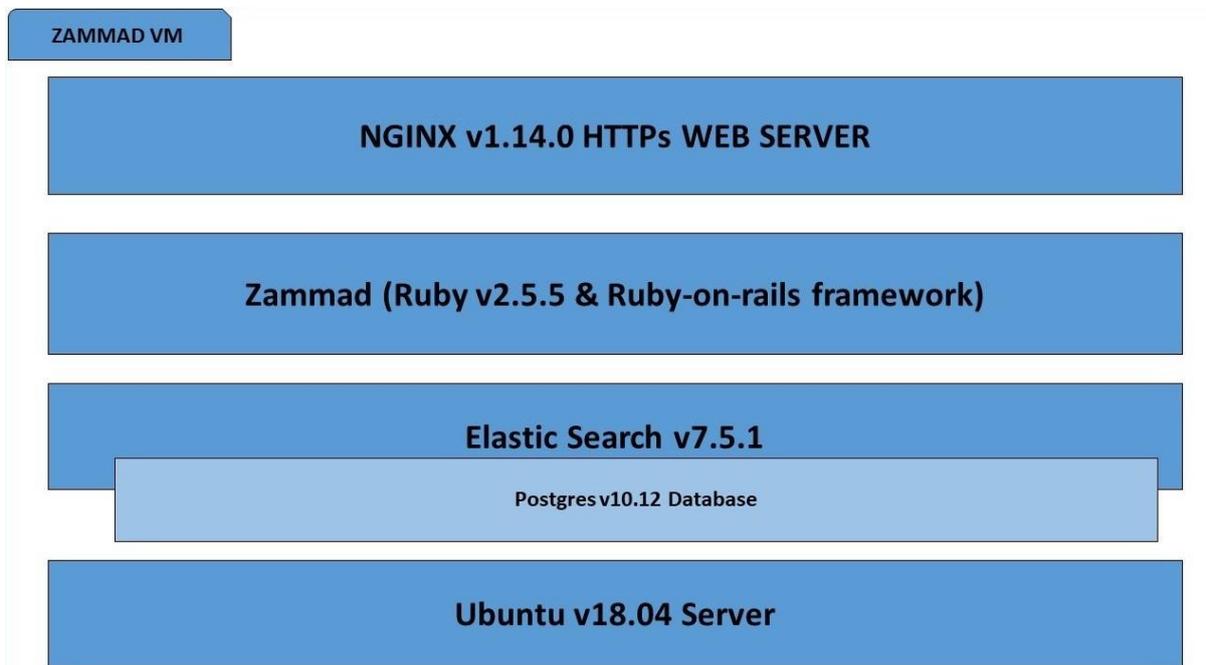
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## 4 Private Support Ticket (Zammad)

This is the sub-supporting system designed to address HiDALGO customers’ problem with the focus of confidentiality. This system allows users to track the status of the ticket by following the ticketing system workflow and raise an escalation to the support manager if the problem is not resolved correctly.

### 4.1 Installation of Zammad

The latest version 3.2.2 of Zammad is installed in the HLRS production infrastructure for earlier user’s access. Ansible script is used for automating the basic installation by using the official Zammad Debian package, so the installation is reproducible within an hour in case the service is down or OS crash. The Zammad installation and its software dependency are detailed in Figure 9.



**Figure 9: Zammad software stack installed in the production VM.**

The Zammad installation is assisted with the open-source software stack – UbuntuV18.04, PostgresV10.12, NginxV1.14.0 and Letsencrypt to provide the SSL certificate. The application is installed with the security best-practices as mentioned below, to protect it from the security vulnerabilities.

1. The HTTPS protocol is used instead of the plain HTTP protocol.
2. Production VM has enabled HTTPS (443) port only for public access. The HTTP (80) port access will redirect to the HTTPS (443) port automatically for ensuring proper

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accessibility and security. The admin SSH (22) port is allowed only for the application administrator with public key authentication and disabled password-based authentication.

3. All the details are stored in the PostgreSQL DB server (including the Zammad admin password) to ensure the customer ticket information is not leaked from the VM. Elasticsearch uses multi-index to sync with PostgreSQL data, and the Zammad application runs reindexing tasks in the background to fetch recent updates regularly.
4. Automatic spam detector is enabled in the application to protect from unwanted tickets and brute-force attacks.
5. Critical information in the Ansible script is encrypted by using the Ansible vault feature.

The support email is created from the official sub-domain with an email forwarding option, which is integrated with the tools successfully for providing email-based customer support. Customers can raise their problems and follow up on them by using e-mails instead of registering in the tools for managing all their activities.

## 4.2 Support ticket life cycle

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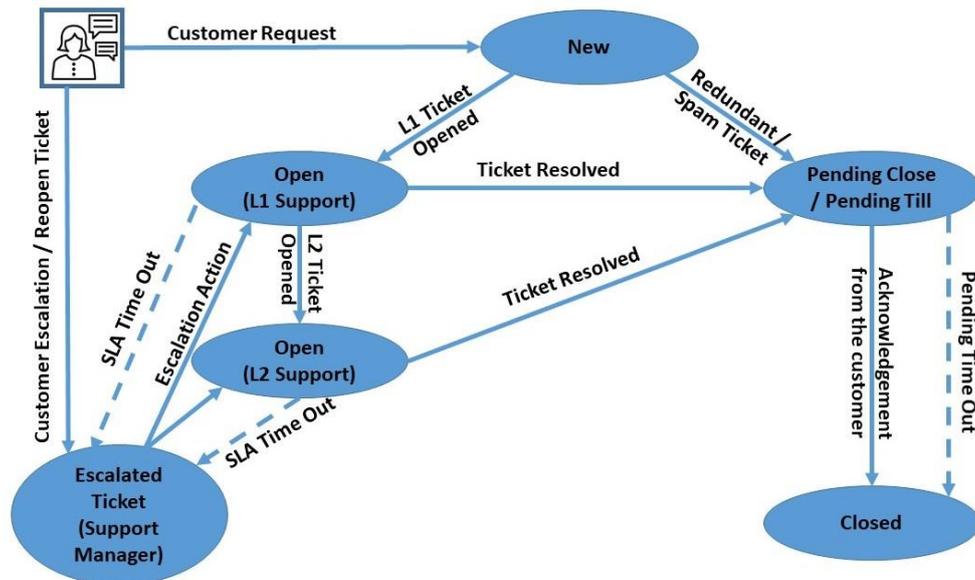
Support ticket flow pictorially provides the high-level picture of ticket operation and different entities involvement for resolving the customer ticket as shown in Figure 10. Customer is the starting point for all the activities to raise their problems – customer request, reopen the ticket, customer escalation. If the customer created a new ticket, then it would be in the “new” state.

1. If the ticket is redundant or spam, then it will be removed automatically by the Zammad tool.
2. If the ticket is not redundant or spam, then automatic acknowledgement email is sent with a unique ticket number for follow-up.
3. The new ticket is automatically set with normal priority.

The L1 support provider is responsible for accepting and opening the ticket for providing a solution as follow.

1. Change the ticket state to “open”.
2. Collect more details regarding the issue.
3. Provide a basic technical solution to resolve the issue and place the ticket into “pending for close” state.
4. Escalate the ticket to L2 support with high priority by L1 agent, if it is not possible to resolve within the L1 group on time.

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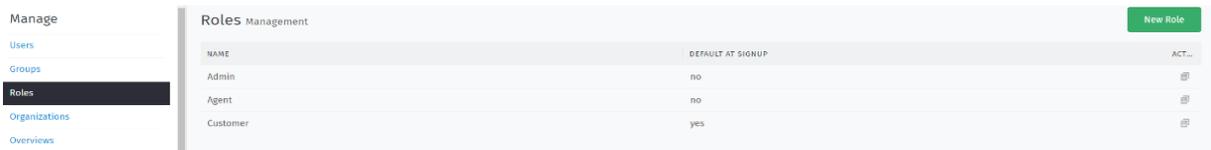
**Figure 10: Support ticket life cycle workflow is detailed from a new state to a closed state. Solid lines are manual workflow and dashed lines are automatic workflow from tools based on the time out settings.**

L2 support provider is responsible for providing an expert solution to resolve the customer issues and place the ticket into pending for close state if L1 support provider could not resolve the issues. If a customer is satisfied with the solution, then the ticket is closed automatically after two days. Otherwise, the customer can escalate it to the support manager with the necessary details. The support manager handles customer escalation and resolves customer issues to build trust and customer satisfaction. The support manager is responsible to monitor the whole activities and ensure the customer tickets are closed according to the SLA metrics by L1 and L2 agents.

### 4.3 Usage of Zammad

Zammad provides both GUI and REST API for interaction with the tools. All the interfaces in the Zammad tool require authentication for accessing the required information and authorization for performing the specific activities. Users' authorization level (Customers, Agents and Admins) is determined by role assignment, which is shown in Figure 11. Different support levels (L1 & L2) are defined by Groups assignment to the user, as shown in Figure 12. New tickets are assigned default to the L1 group and the agents have the permission to change the groups and assign them to another agent. Different types of users, roles and groups are detailed in Table 7, which is used to define authorization and responsibilities. SLAs are defined for the different situation as shown in Figure 13, which is used to automatically raise escalation from the tool. Users can search their corresponding ticket details in the search box based on the keywords as shown in Figure 14. Acknowledgement Email is sent automatically from the tool after creating the new ticket as shown in Figure 15.

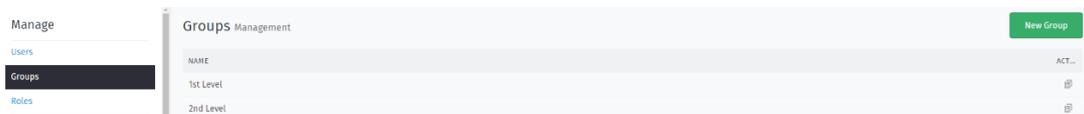
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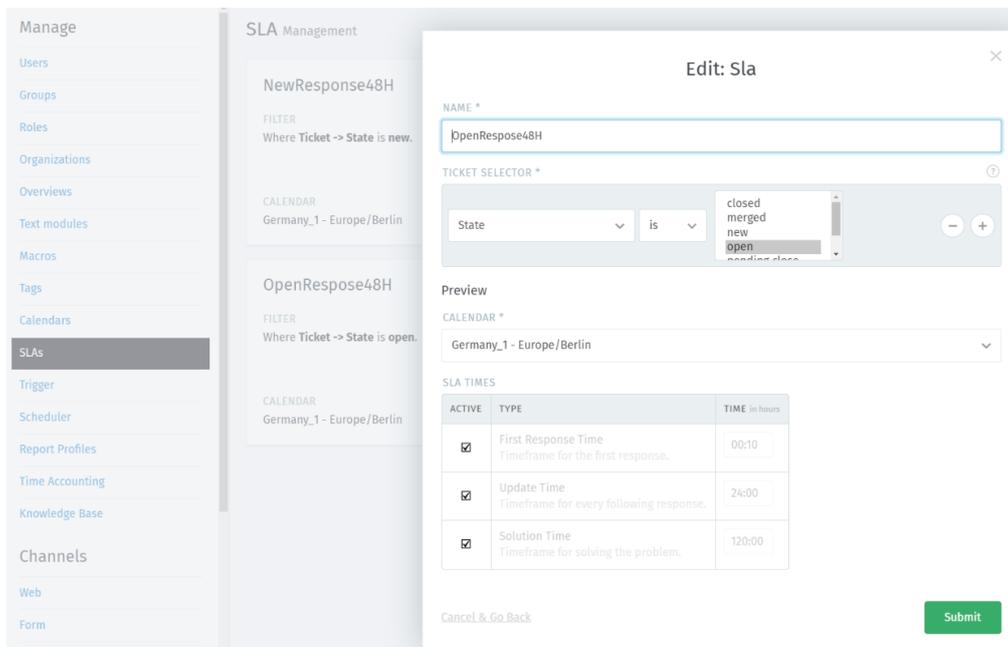
**Figure 11: Different roles in the Zammad tool.**

Users	Roles	Groups
Support Manager	Agent	L1 and L2 Group
L1 Agent	Agent	L1 Group
L2 Agent	Agent	L2 Group
Any Users / Consumers	Customers	No Group
The administrator of Zammad application	Admin	Complete control of the application administration

**Table 7: Roles and groups assignments for the different users in Zammad tool.**

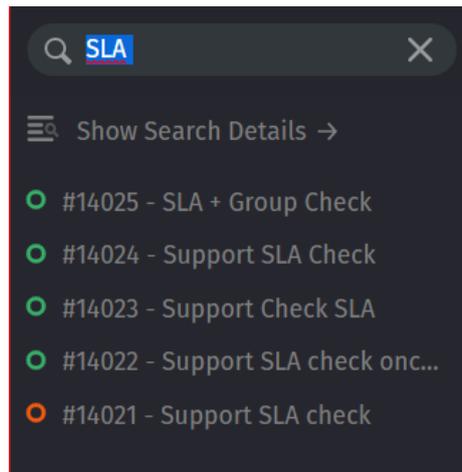


**Figure 12: Different groups are used for assigning L1 and L2 support.**

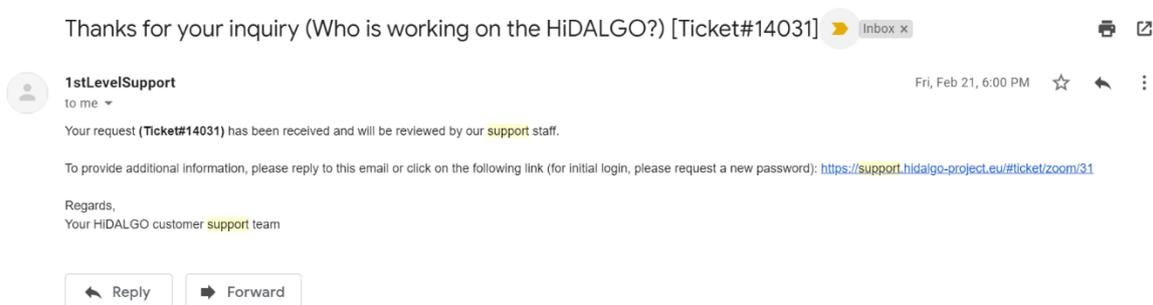


**Figure 13: SLAs defined for the new ticket.**

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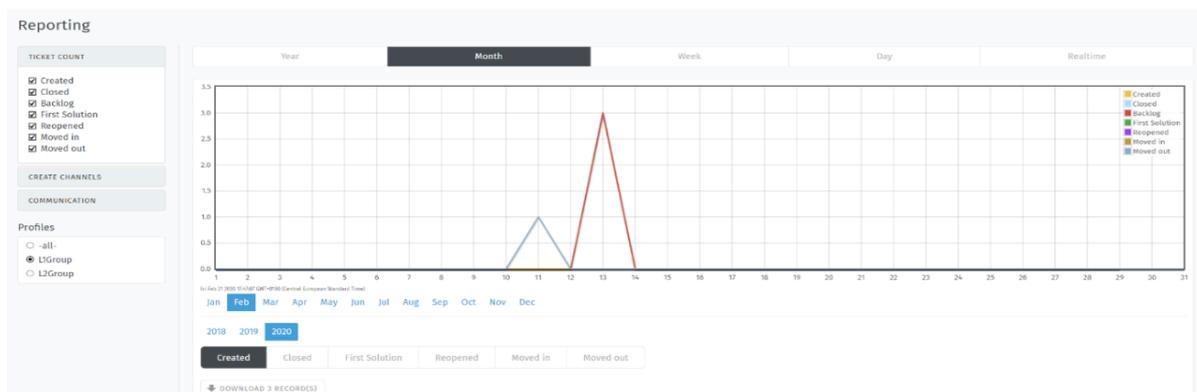


**Figure 14: Users can search ticket based on the keywords.**



**Figure 15 Automatic email is sent to the customer after creating the ticket.**

Admin and agents can generate the automatic report for further analysis to improve the service as shown in Figure 16. Customer can create a ticket by using the ticketing tool directly after registration in the HiDALGO portal as shown in Figure 17. Agents can address the ticket by changing state, priority and respond to the ticket via the tools and get escalation details as shown in Figure 18. Zammad provides REST API, which is summarized in Annexes Table 9 and more details can be found in the Zammad official documentation [35].



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**Figure 16: Automatic report to get different metrics.**

## New Ticket

TITLE \*

Ticket issue subject <High-level>

TEXT \*

Ticket issue complete details

[select attachment...](#)

STATE

new

[Cancel & Go Back](#) **Create**

**Figure 17: Create a ticket by users.**

Ticket# 14019
Escalation Check
02/11/2020

Reopen the ticket by email.

Thanks  
Dineshkumar RAJAGOPAL,  
Service Management & Business Processes  
Hochleistungsrechenzentrum Stuttgart  
Universität Stuttgart  
Nobelstraße 19  
70569 Stuttgart

----- Original Message -----  
[See more](#)

02/11/2020

set to internal   reply   forward   split

AT

Okay, we will reopen it.

02/11/2020

set to internal   reply   forward   split

TO

dineshkumar.rajagopal@hirs.de

CC

AT

Hi,  
Your ticket is resolved by addressing the issue "..."]

[select attachment...](#)

Discard your unsaved changes.
Stay on tab
**Update**

Ticket

GROUP \*  
2nd Level

OWNER  
2ndLevel PSNC

STATE \*  
open

PRIORITY \*  
3 high

TAGS  
+ Add Tag

LINKS  
+ Add Link

**Figure 18: Agent responding ticket by email and changing state, priority.**

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## 4.4 Integration with the HiDALGO portal

Zammad provides SSO support with third-party authentication, so the tool can be authenticated and authorized through the Keycloak IDM as defined in the deliverable D5.3 [31]. SAML2.0 and OAuth2 authentication are officially supported in the latest version of the Zammad tool. This feature can be enabled easily by adapting the configurations to provide SSO authentication with the HiDALGO portal and Keycloak IDM, as shown in Figure 19.

**Authentication via Generic OAuth2**  
Enables user authentication via generic OAuth2. Register your app first.

NAME

APP ID

APP SECRET

SITE

AUTHORIZE\_URL

TOKEN\_URL

---

**Authentication via SAML**  
Enables user authentication via SAML.

IDP SSO TARGET URL

IDP CERTIFICATE

IDP CERTIFICATE FINGERPRINT

NAME IDENTIFIER FORMAT

**Figure 19: SSO support in Zammad.**

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## 5 Conclusion

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HiDALGO support concepts are strengthened by adopting the industrial standard of the ITSM service management framework to define multiple sub-supporting systems, two levels of service operations, the RACI responsibility assignment, and metrics to evaluate the system. The public support forum and private support ticket are the two sub-supporting systems defined and installed to provide free customer support for resolving the customer issues promptly. The HiDALGO free support system is aimed at building an active HiDALGO user community and leveraging the trust of customers to establish a base for provisioning commercial service and support. Support tools are identified from the open-source market by following standard market analysis procedures and installed in the production VMs for providing stand-alone services for HiDALGO users. Different metrics will be collected from the tools for further analysis and the CSI principle will be applied to improve the support system operation in an agile way. The HiDALGO support service will be released for public user access after the evaluation of internal user tests and completion of the integration with the HiDALGO portal. The HiDALGO support system will be additionally improved by the following the best-practices in the support tools installation and detailed in the future deliverables D5.6 as mentioned below.

- All the tools will be integrated with the HiDALGO portal by providing SSO authentication and authorization to provide unified user access capability.
- The Jenkins pipeline will be defined with the Ansible script to establish a CI/CD pipeline for HiDALGO portal development.
- All the production VMs are monitored with automatic monitoring tool (Nagios) to be able to report failure in the system in order to ensure high-availability in the service provisioning.
- Backup and restore mechanisms will be established to protect the tools from the vulnerability and potential loss of data.

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## Annexes

REST API of Askbot and Zammad are given in Table 8 and Table 9 respectively.

Command	Function	Example response
GET <host>/api/v1/info/	Gives overall statistics about the forum – number of groups, users, questions, answers and comments.	<pre>{ "groups": 0,   "users": 2,   "questions": 1,   "answers": 0,   "comments": 0 }</pre>
GET <host>/api/v1/users/	Gives a list of users along with their general statistics. Additional parameters can be sent for sorting and filtering.	<pre>{ "count": 2,   "pages": 1,   "users": [   {     "username": "admin",     "gold": 0,     "joined_at": "1581081889",     "silver": 0,     "reputation": 1,      "avatar": "http://localhost/m/default/media/images/nophoto.png?v=1",     "last_seen_at": "1582541475",     "id": 1,     "bronze": 0   },   ...   ]}</pre>
GET <host>/api/v1/users/<user_id>/	Gives general statistics about selected user.	<pre>{ "username": "admin",   "gold": 0,   "joined_at": "1581081889",   "answers": 1,   "questions": 0,   "id": 1,   "bronze": 0,   "comments": 0,   "silver": 0,   "reputation": 1,    "avatar": "http://localhost/m/default/media/images/nophoto.png?v=1",   "last_seen_at": "1582541475" }</pre>
GET <host>/api/v1/questions/	Gives an overall summary of the forum – number of questions, number of pages and a full list of questions currently accessible (with answers and details). Additionally the parameters can also be sent with the	<pre>{ "count": 1,   "pages": 1,   "questions": [   {     "tags": [],     "answer_count": 0,     "accepted_answer_id": null,     "answer_ids": [],     "id": 3,     "last_activity_by": {</pre>

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Command	Function	Example response
	request to add filtering and sorting of results.	<pre> "username": "asdf", "id": 2 }, "view_count": 4, "last_activity_at": "1581425670", "title": "What is HiDALGO?", "url": "http://localhost/question/3/what-is-hidalgo/", "author": { "username": "asdf", "id": 2 }, "added_at": "1581425670",  "summary": "&lt;p&gt;What is this project? Who all are involving?&lt;/p&gt;\n", "score": 0 } ]] </pre>
GET <host>/api/v1/questions/<question_id>	Gives information about selected question, such as statistics, answers, overview.	<pre> { "tags": [], "answer_count": 1, "accepted_answer_id": null, "answer_ids": [ 4 ], "id": 3, "last_activity_by": { "username": "admin", "id": 1 }, "view_count": 4, "last_activity_at": "1582541470", "title": "What is HiDALGO?", "url": "http://localhost/question/3/what-is-hidalgo/", "author": { "username": "asdf", "id": 2 }, "added_at": "1581425670",  "summary": "&lt;p&gt;What is this project? Who all are involving?&lt;/p&gt;\n", "score": 0 } </pre>

Table 8: Askbot's REST API

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Command	Function	Example response
GET, PUT, POST, DELETE <host>/api/v1/users/	Perform CRUD operations on users details.	<pre>{   "id": 123,   "firstname": "Bob",   "lastname": "Smith",   "email": "bob@smith.example.com",   "note": "some note",   "updated_at": "2019-08-16T07:55:42.119Z",   "created_at": "2019-08-16T07:55:42.119Z",   ... }</pre>
GET, PUT, POST, DELETE <host>/api/v1/groups	Perform CRUD operations on groups details.	<pre>{   "id": 123,   "name": "Group 1",   "signature_id": 123,   "email_address_id": 123,   "assignment_timeout": 180,   "follow_up_possible": "yes",   "follow_up_assignment": true,   "active": true,   "note": "some note",   "updated_at": "2019-08-16T07:55:42.119Z",   "created_at": "2019-08-16T07:55:42.119Z" }</pre>
GET, PUT, POST, DELETE <host>/api/v1/tickets	Perform CRUD operations on tickets details.	<pre>{   "id": 123,   "title": "Help me!",   "group_id": 1,   "state_id": 1,   "priority_id": 2,   "customer_id": 2,   "note": "some note",   "updated_at": "2019-08-16T07:55:42.119Z",   "created_at": "2019-08-16T07:55:42.119Z",   ... }</pre>
GET, PUT, POST, DELETE <host>/api/v1/online_notification	Perform CRUD operations on tickets notification details.	<pre>{   "id": 123,   "o_id": 628,   "object": "Ticket",   "type": "escalation",   "seen": true,   "updated_at": "2019-08-16T07:55:42.119Z",   "updated_by_id": 123,   "created_at": "2019-08-16T07:55:42.119Z",   "created_at_id": 123 }</pre>

**Table 9: Zammad's REST APIs.**

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